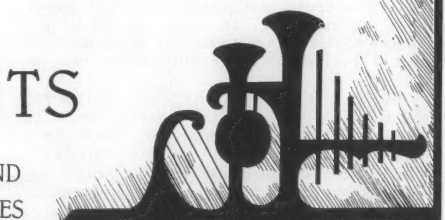
VOLUME II NUMBER 5 FEBRUARY 1987 PRICE 3.50

EXPERIMENTAL MUSICAL INSTRUMENTS

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF NEW SOUND SOURCES



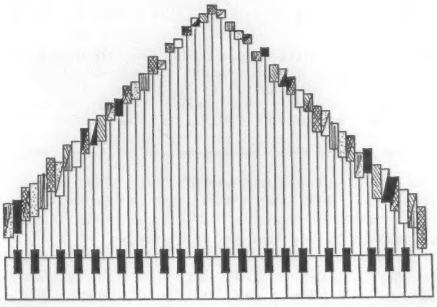
THE BIG NEWS this month is **Making Music**, an exhibit of new and unusual instruments taking place at the California Crafts Museum in San Francisco. The work of about twenty builders is being shown, including many who have appeared in EMI, and many more who have not. Among them are several of those who have been exploring new instrumental possibilities longest, and from whom younger builders have learned the most, including Bill Colvig, Ivor Darreg, and Erv Wilson. Harry Partch is very much there in spirit, and is represented by the original Kithara I. At the other end of the spectrum, many fine, innovative and imaginative instruments by relatively unknown builders are being shown for the first time.

The gallery show includes a high quality audio program providing the essential other half of the instruments' personalities. The show catalog gives fuller information on the instruments and builders, and it includes a full length cassette tape.

Also planned in conjunction with the show is a concert series. At the time of this writing details and dates have not been fixed, but I think it's safe to leak the information that some very interesting programs are being talked about.

The show began January 17th and will run until April 5th. The venue is the California Crafts Museum, in the Chocolate Building at Ghirardelli Square, 900 North Point, San Francisco, California, phone (415) 771-1919. Subscribers to EMI will be receiving more complete information directly from the museum.

(continued on page 3)



Above right: ALTERNATIVE KEYBOARDS -- article starts on p. 4. The diagram here is by Bob Phillips, illustrating a special mapping of pitches onto a standard 7-5 keyboard.

IN THIS ISSUE

LETTERS

With my renewal check I just wanted to tell you how much I enjoy your -- well, what is it? A magazine? Not really. A pamphlet? That sounds vaguely subversive, and also insignificant. Leaflet, periodical, publication, rag....I dunno. Whatever its true name, it stands as one of the few pieces of literature I actually read, amid the stacks of published matter that comes into my house.

I have yet to build a musical instrument, though it is in my five-year plan to do so! I've had some experience rebuilding some, since I'm a piano tuner and technician. I've just published a book about equal temperament and piano tuning, The Seventh Dragon: The Riddle of Equal Temperament, so your most recent article about just intonation was very welcome (especially since nothing in it contradicted anything I said in my book, which was a relief!)

I hope your publication-magazine-periodical continues for a long time.

Anita T. Sulivan

Editor's note: Anita's book, **The Seventh Dragon: The Riddle of Equal Temperament** was winner of the Western States Book Award for nonfiction in 1986. It is published by Metamorphous Press, PO Box 1712, Lake Oswego, OR 97030 and the price is $12.95.

Re "Un-Invented Instruments" [Vol. II #2], The Sticcolo -- It's been done. The pre-Columbians had one with an air-duct 1000 or so years ago. I've made ones for six or so years -- with and without air-ducts; with and without membranes; long, short; blowhole in the middle and in various positions along the sides. They're all great fun. I guess we're all reinventing the wheel.

Susan Rawcliffe

Thank you for sending the past issues I ordered. This is the publication I've been waiting for since I played my first drainpipe several years ago.

In Vol I #4, you mention the problem of destructive communication in the construction of a nail violin. Having made one without encountering this problem, I am curious about your design.

You mention using "spikes;" I used finishing nails, sizes 4-12 anchored into a 1 ¼" thick semicircular section of laminated maple through a 1/8" Koa soundboard. The instrument has a range of G4 to E7, tuned chromatically. Although the lower 5th is somewhat weak, the instrument speaks in a fine, soft whistle-like tone that is especially clear and bright in the upper octave.

The overall timbre, however,is quite dry, so it would not go well with veal or chicken.

With larger, more massive nails, perhaps a larger anchoring block would be needed. -- But I can't really address the problem without knowing more about your design.

--Liked your Disorderly Tumbling Forth, Ellen Fullman's Long String Instrument, Mothra, and generally instruments using unusual means of sound production.

Keep up the good work.

Michael Meadows

From the Editor: That "Destructive Communication" article has haunted me quite a bit, since it contained an important assertion which proved to be false. Several people recognized the error (see the editorial and letters columns of the two following issues). The article used the term "destructive communication" to describe a phenomenon that can occur in musical instruments with multiple, rigidly attached initial vibrating

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SUBMISSIONS: We welcome submissions of articles relating to new instruments. Articles about one's own work are especially appropriate. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

elements. In many such instruments (I used my troublesome nail violin, along with steel pans and many-tongued slit drums as examples), the vibrations of the not-really-independent vibrating elements can be communicated one to another through the body of the instrument. If their natural frequencies are not in some very simple ratio, then the vibrating elements may interfere with one another, killing one another's resonance, detuning each other, or altering the overtone mix. The article's mistake was in saying that this problem is worse than it turns out to be in actual practice, and that it makes independent tuning impossible in a lot of situations where it in fact is not impossible.

Looking at Michael's description of his nail violin, I see a lot of similarities to my design (most notably, the fine, soft, whistle-like tone), and a couple of differences that could explain why I had trouble where he did not. Mine was chromatic 12-equal, and it was specifically with adjacent semitones that I had trouble. An isolated nail, before its neighbors were put in or tuned to the semitones above and below, never gave trouble. The soundboard was 1/8" hardwood plywood (I don't recall specifically what sort of wood). The nails were finishing nails like Michael's, but they were not set at the periphery and anchored in the heavier sides as his apparently were, but inset about two inches. The diatonic nails were anchored in small hardwood pieces glued at the appropriate places to the underside of the soundboard. The sharps and flats were raised on small wooden blocks, about $\frac{1}{2}$x$\frac{1}{2}$x$\frac{1}{4}$", glued to the top of the soundboard. All this makes me suspicious: Maybe the heavy sides of Michael's instrument somehow helped isolate the individual nails, while mine, mounted in the freer-to-vibrate parts of the soundboard, communicated the vibrations between the nails more readily; perhaps even amplified them. This goes against my remarks in the "Destructive Communication" article though, where I laid the blame on the rigidity of the body and the connections of the initial vibrators to it.

I made a big, wide-arcing bow for the instrument, using horsetail which I actually plucked, strand by strand, from the rump of an acquiescent horse. I played the thing in concert once. Foolishly I used it on a somewhat serious piece, and midway through the nail violin solo I got the bow hairs all tangled up in the nails. Quite embarrassing/funny.

By the way, it's clear from Michael's description that his nail violin was considerably better made than mine, which used questionable materials and my own frequently-shoddy craftsmanship. That too may help explain why his worked better.

(continued from p.1)

For those who are interested but are prevented from seeing the exhibit by oceans or similar intractable obstacles, the catalog and accompanying tape are available from the Museum Shop, California Crafts Museum, at the above address for $20 plus $2 postage and handling.

The most prominent article in this issue is one on new approaches to keyboard design, viewed both in terms of the mechanics of playability and the conceptual organization of pitches. There has been a surfeit of articles on related subjects in other periodicals lately; this one is designed to direct interested readers to those and other sources, as well as to provide an overview of the subject, augmented by some interesting additional odds and ends. I would also like to direct readers to this issue's seemingly inconspicuous book review: it looks at a collection of early catalogs from the J.C. Deagan Company, now reprinted by the Percussive Arts Society. Those catalogs turn out to be an unexpected treasure trove of intriguing and unusual instruments, now nearly forgotten.

NOTICES

THE NEW INSTRUMENTS / NEW MUSIC SERIES CONTINUES

This month's presentation in the New Instruments / New Music series was a solo performance by the series organizer, Tom Nunn. Tom played Earwarg II and a new incarnation of the Crustacean. The former is one of his electro-acoustic percussion boards, made up of a plethora of sound-producing devices, many of them rather tiny, affixed to a table-like board with a pickup attached. The Crustacean is a set of rods mounted on a resonator in the form of a flexible steel sheet, resting on balloons. The instruments work beautifully in the intimate performance setting the concert series provides, and Tom's performance spoke irresistibly of possibilities hitherto scarcely imagined.

The concert series is coming to be known affectionately as "The Odd First Sunday Series," in honor of its scheduling arrangement. The events take place at 2:00 PM on the first Sunday of each odd-numbered month, at 3016 25th Street in San Francisco, 94110. It has not yet been determined who will perform in the coming March concert. For more information, or to get on the mailing list, write the above address or call (415) 282-1562.

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DID YOU GET THE NEW EMI TAPE YET? **From the Pages of Experimental Musical Instruments Volume I** includes music from instruments featured during EMI's first year of publication. The work of ten builders playing one or several instruments each is included. You've read about the instruments; now you should hear them -- this is the tape that completes the picture, and an exhilarating picture it is. The price is $6 for subscribers; $8.50 for non-subscribers (postage included), from Experimental Musical Instruments, PO Box 784, Nicasio, CA 94946.

MAKING MUSIC, an exhibit showing some of the very finest new work in experimental musical instrument design and construction, is taking place at the California Crafts Museum in Ghirardelli Square, San Francisco, from January 17 through April 5, 1987. A concert series will take place in conjunction with the exhibit. For more information see page 1 of this issue,or call or write California Crafts Museum, Chocolate Building, Ghirardelli Square, 900 North Point, San Francisco, CA 94109, (415) 771-1919.

KEYBOARD ALTERNATIVES
Some opening thoughts & background by Bart Hopkin

"One standardized apparatus of this sort, which has been gradually developed over a long period, has come to be universally adopted: it is by no means the most convenient imaginable, but the conservatism of musicians will probably prevent its supersession unless some drastic change in the scales used in music (e.g. by the general adoption of microtones) makes such a change imperative."

--from The Concise Oxford Dictionary of Music's entry under "Keyboard."

Until recently Experimental Musical Instruments had contemplated running a series of articles on keyboard layouts alternative to the traditional 7-5 arrangement. A number of articles and special issues on keyboards have appeared recently in other publications though, so we've set aside the idea of a full series. Instead we present this piece, which falls somewhere between an overview and a scrapbook on keyboard explorations. Included are several odds and ends, plus a closer look at one new layout in particular, the Sohler Keyboard. Bibliographic information for some of the keyboard articles that have appeared elsewhere recently may be found on page 7.

SOME BACKGROUND

The layout of the standard keyboard -- the familiar pattern of five raised black keys distributed between the seven white keys of the octave -- was never invented or planned in any clear sense. Nor did anyone ever make a definitive decision that this was in some way the most desirable arrangement. It came into being, rather, in an evolutionary process involving many musicians and builders, occurring over several centuries.

The earliest mechanisms usually recognized as keyboards were the sets of levers which operated ancient organs. Though the definitions become a bit vague and the history highly conjectural, one could maintain that this takes us back as far as the Greek hydraulis, known in the third century AD and earlier. We are on more solid ground, however, talking about instruments associated with the church music of medieval Europe. (Liturgical use of the organ was being practiced by sometime around the tenth century AD.) These early instruments, intended for use with the diatonic church modes, were usually controlled by a set of broad, flat levers, widely spaced, protruding from the front of the instrument. A set of seven such keys to the octave, lying in a single even row, may have originally been the norm. Early on, a single additional key appeared, usually in the same plane as the other seven, to operate a Bb pipe.

Beginning around the thirteenth century, as the music evolved and the need for greater tonal flexibility began to be felt, progressively more chromatic keys appeared. It became common for these to be distinguished from the diatonic keys by placing them above. (Bb, for quite some time, continued to appear in the lower row.) By the 15th century, an arrangement much like the present one had become widespread, with the seven diatonic keys below and five chromatic keys (now including Bb) above. The keyboard still tended, though, to take the form of rows of protruding levers, rather than the familiar bed of ivory and ebony we see today.

Over the following centuries the keys gradually settled into something closer to the shape and positioning now in use. The five-seven arrangement was adopted for new instruments, including the mechanized zithers better known as harpsichords and pianos. Woods and colors used in the keys changed from time to time before settling on the white ivory and black ebony, and, more recently, the plastics, of contemporary instruments. It also was sometime before the exact spacing and width of the keys arrived at the present day standard. But in those several hundred years, no change has occurred in the basic arrangement of the pitches. The vast majority of keyboards built today remain true to the ancient design.

But not all. In the years intervening between the evolution of the standard design and the present, there has occasionally been ferment, debate, and exploration of other possible keyboard layouts. Over the last few years, interest in the subject has decidedly picked up once again. To better understand the reasons for this and some of its implications, let us look at the concept of "keyboard" in a broader perspective.

The function of a keyboard can be seen as twofold. Most obviously, keyboards are mechanisms for making the many pitches of certain musical devices easily accessible to somebody's ten fingers. From this point of view the most important consideration in keyboard design is that it be well suited to the human hand. To do this we substitute the simple motion of pushing a key for other more demanding means of sounding the note. We then arrange the keys in such a way that the fingers can reach them and perform complex key-pushing patterns as easily as possible.

The second purpose in keyboard design is more abstract. If we are going to create a spatial arrangement for the musical pitches available to us, we should also consider how we wish to organize them from a purely conceptual point of view. In creating a keyboard we are choosing how to lay out graphically our musical grid. We are creating a framework on which we can hang our musical ideas, and it should sit well with the ways we think about music, enhancing our ability to visualize and manipulate musical constructs.

The standard keyboard did this, though perhaps awkwardly, during the period of its evolution. Its form reflected important tonal relationships inherent in European music of the time. In it was the embodiment of the basic seven tone scale,

augmented by the several bastard tones that arose from the desire to be able to change tonal centers. With the rise of equal temperament and the later movement to place all twelve notes on an equal footing, the asymmetrical two-tiered arrangement may have become conceptually anachronistic, but it remained in place.

Another example -- not a keyboard in the European sense but fine instance of the conceptual organization of pitches -- is the arrangement of tongues on many African thumb pianos. In the most common layout the longest and lowest-pitched tongue is at the middle of a single row. The tongues get shorter and higher in pitch towards both ends, in such a way that to play a scale one alternates sides, plucking left-right-left-right, moving out from the middle. This arrangement sits nicely with the two hands, making fast scale passages natural and comfortable. More to the point, it means that adjacent tongues on either side are a third apart, and playing in thirds by striking two keys in one stroke is, likewise, natural and comfortable. This reflects one of the prominent features of most of the music cultures that spawned the arrangement, the importance of thirds: parallel thirds arising everywhere in melodic harmony, and the piling up of thirds upon one another in what Europeans tend to hear as chordal harmony. One contemporary builder has been applying the kalimba layout to an actual keyboard. The arrangement for Bob Philips' Limbaclav keyboard is diagrammed below.

As we consider the ways in which the physical layout of the keyboard can reflect relationships inherent in our musical systems, we should also ask the reverse question: To what extent should the physical layout of the keyboard be allowed to determine the nature of the music? One could argue that the keys should be arranged in a manner that will tend to bias our choice of musical

THE LIMBACLAV KEYBOARD diagrammed below is an alternative system for mapping pitches onto a conventional keyboard, designed and applied to existing instruments by Bob Phillips. Bob designs and builds instruments of all sorts; of late he has been emphasizing what he calls "modular design" -- making instruments with interchangeable sounding elements, allowing for varying scale and pitch configurations. He welcomes correspondence, and can build custom instruments of all sorts on commission. Contact Bob Phillips c/o Research and Musical Development, 1315 Dodge Ave, Ft. Wayne, IN 46805; (219) 482-1213.

The Modern Keyboard.

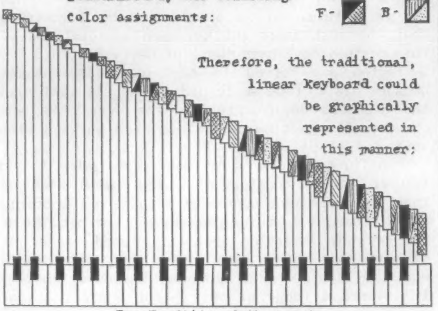
By the 18th century, the modern, linear keyboard (as we know it today), had completely evolved.
Over the years, it has been altered many times to limited degrees of success and acceptance. To this day, there is only one keyboard design that is universally accepted and successful.

An Arbitrary Color Code.

Many attempts have been made to discover a link between sound and color. This arbitrary color code is not one of those attempts. The twelve tones that make up the chromatic scale are identified by the following color assignments:

C- F#
C# G-
D- G#
D# A-
E- A#
F- B-

Therefore, the traditional, linear keyboard could be graphically represented in this manner:



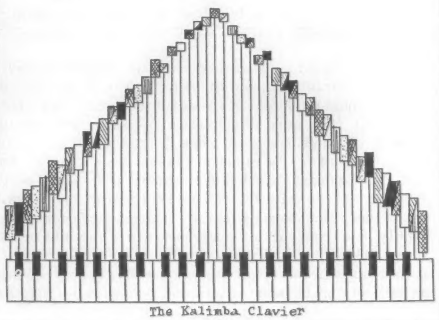
The Traditional Keyboard

The Kalimba.

The African kalimba (mbira), ergonomically designed by observing the thumbs' swinging arcs, represents a more organic approach to the construction of melodies, harmonies, and rhythms.

The Limbaclav.

The Limbaclav (kalimba clavier) offers this identical, symmetrical access to the keyboard's tones. With the lowest pitch assigned to the center key and each successive, diatonic tone found at locations that alternate left, right, left, right (outward from center), the graphic layout would be represented thus:



The Kalimba Clavier

patterns as little as possible -- that is, will allow us to choose notes on the basis of purely musical relationships, rather than the positioning of the keys and the physical inclinations of the hand. On the other hand, every instrument has its characteristic gestures -- physical gestures that occur in playing, and the stylistic musical gestures that arise from them. This characteristic of mankind's music making machines contributes an awful lot of welcome spice and variety to our musical universe. Would we really want to refine it out of keyboards? This question need not be formally resolved, but as we devise or analyze our musical grids it is worth thinking about.

In light of the two keyboard design considerations discussed above -- physical playability and conceptual organization of pitches -- it becomes clear that, as our music continues to evolve, the time may have come to consider alternative keyboard designs. Many would say the time actually came long ago. There have in fact been several voices in the wilderness in the last century, suggesting better possibilities. None, thus far, have gotten far with their ideas. The reasons for the keyboard-conservatism of so many musicians are not hard to see: they are the same as the reasons why the USA, despite many admirable pronouncements, can't seem to make the transition from British measurements over to the metric system. It's just plain hard to make the switch once an older system is entrenched. And this will be especially true with something learned as painstakingly as the piano keyboard. What musician would want to cast aside all that effort, when so many have finally reached the point where, despite its difficulties, the system seems to serve them well?

But I can cite a counter-example: Why is it that shape-note singing managed to become popular throughout the Southeastern United States, despite an equally strong entrenchment and musical conservatism regarding traditional notation (which is in many ways as awkward and anachronistic as the piano keyboard)? The answer here probably lies in the fact that shape-note singing found its popular base among non-musicians. They had no entrenched system to cling to, and willingly embraced the one which immediately served them best. There may be a lesson here for alternative keyboardists.

Let us now take brief look a few of the alternative keyboard systems that have been proposed over the years.

The earliest variations on the standard keyboard -- variations which could perhaps be viewed as continuations in its evolution, but for the fact that they were short-lived -- were the double enharmonic keys found in some 16th and 17th century instruments. These were raised keys similar to the contemporary black keys except that they were divided at the middle, actually forming two keys. The front and back portions functioned independently and controlled separate pipes or strings. This allowed for playing in meantone or just intonations in which two different pitches might be called for between a pair of naturals -- tonalities in which, for example, the note spelled G# is not identical to the note spelled Ab. The widespread acceptance of twelve-tone equal temperament around the 18th century permanently fused G# into Ab, and made such divided keys unnecessary.

With equal temperament firmly in place, several thinkers have since proposed keyboard designs which reduce the tonal bias toward C major inherent in standard keyboards. One way of doing this is by dividing the chromatic scale into two complementary whole tone scales. The lower "white keys" would consist of C#, D#, F, G, A and B, while the raised black keys would be C, D, E, F#, G# and A#. This arrangement was suggested by one William A. B. Lunn in 1843, and advocated again by a German musical society thirty-odd years later. The tradition is carried on today by the Musical Six-Six Society in Kirksville, Missouri (see the bibliography at the end of this section).

In 1882 Paul von Janko patented an extension of the idea, in which six rows of keys (much shorter than standard piano keys) are placed above one another. Any two adjacent rows comprise a pair of complementary whole tone scales, and each pitch may be sounded by any of three keys. The advantage of the redundancy is that it allows the hand to travel vertically between rows, bringing more notes within the reach of the hand and allowing for identical scale patterns in all keys. This design met with temporary success after its introduction. Around the turn of the century, in fact, there was a Janko Conservatory in New York and a Janko Society in Vienna.

In 1876 a bilateral keyboard was patented by E.J. Mangeot, which amounted to a conventional keyboard at right and a reversed keyboard, with the pitches ascending in the opposite direction, on the left. The idea was to allow for identical patterns in the left and right hands.

The Clutsam keyboard, patented in 1907 [referred to in the comments on the Time Magazine article appearing a few pages hence], was built with a slight curve to partially envelop the player, bringing the extreme bass and treble within easier reach.

In recent years the strongest impetus to keyboard design research has been the rise in interest in intonational systems aside from twelve tone equal temperament. The standard keyboard is not suited to any system not possessing twelve tones to the octave. So it should not be surprising that the most important keyboard explorations of this century have been those of Harry Partch.

Partch was forced to seek out alternatives because his 43 tone scale did didn't sit well with the standard design, to say the least. He approached the problem several ways in working with various instruments.

His Chromelodeans were harmoniums rebuilt and retuned to his preferred scales. With them he took the convenient course of retaining the original keyboard and simply reassigning the pitches of the keys by inserting specially tuned reeds. At 43 notes per octave this meant that an octave's worth of keys on the traditional keyboard generally covered a range of only about a minor third,

and the whole compass was correspondingly narrow. For the purposes to which he put the instrument -- many of which had to do with research, demonstrations, tuning of other instruments and, in performance, sustained tones -- the system was adequate. Partch labeled the individual keys with pitch names in the form of ratios, as a guide to the player.

The Chromelodians make a better lesson in short-term practicality than in keyboard design. Much more to the point, for the purposes of this discussion, are Partch's Diamond Marimbas. In the process of organizing his tonal thought and formalizing his music theory, Partch created what he called the **Tonality Diamond**. It was a diamond-shaped graphic design which laid out in two dimensions what he regarded as the essential pitch relationships. He incorporated this pattern into the layout of bars in his Diamond Marimba. In place of the traditional two rows of keys along single line, he thus created an array of musically significant relationships all in a plane, but fully two dimensional. Then, as if to illustrate our earlier remarks about **gesture**, he built a second diamond shaped marimba, the Quadrangulis Reversum. The original Diamond Marimba, it seems, had an innate affinity for downward arpeggios and glissandos, resulting from the arrangement of the bars in combination with the natural playing motions. Partch set out to complement that by creating a corresponding instrument for which upward sweeps would be natural. This he did by building the Quadrangulis Reversum with a similar tonality diamond, but with the layout of the bars reversed.

A third contribution by Harry Partch to contemporary keyboard exploration remains to be mentioned here. Partch was a great frequenter of public libraries. And despite a pronounced anti-academic bent, he was a dogged researcher. He brought to light a number of obscure earlier keyboard designs and discussed them in his writings. Some of them have influenced contemporary designers greatly. Most notable among them has been the design for a 53-tone equal temperament harmonium keyboard created by R.H.M. Bosanquet. On Bosanquet's harmonium the keyboard looks a little like an elaborate version of the rows of levers of the early organs, but in the abstract Bosanquet's design is another two dimensional array. Its basic design principles can be adapted to equal temperaments of varying numbers of tones. Erv Wilson, a contemporary theorist working in Southern California, has applied Bosanquet to several temperaments. The conduit and glass marimbas built by Stephen Smith and described in **EMI** Vol. II #1 use Erv Wilson's adaptations of Bosanquet's design.

Erv Wilson is one of several people currently working in nonstandard keyboard design. For more on recent activity in this field, we can direct you to some of the other publications that have published special keyboard issues recently, as we promised to do a few pages back. Here, then, is that short bibliography.

RECENT ARTICLES IN EMI AND OTHER PUBLICATIONS RELATING TO EXPERIMENTAL KEYBOARDS

1/1 ran a special keyboard issue in Autumn, 1985 (Vol. I #4). Articles by Harold Waage, Robert Rich, Erv Wilson, Norman Henry and David Canright discuss some new and some old alternative keyboard layouts and their application, plus electronic means of allowing the conventional keyboard to meet more demanding intonational requirements.
1/1 is published by the Just Intonation Network, 535 Stevenson Street, San Francisco, CA 94103, USA.

Interval published a special issue entitled **A look at New Keyboards** as Vol. V #2, Spring 1986. Articles by Siemen Terpstra, Douglas Keislar and James Davis discuss two more unique and very interesting two dimensional arrays, and the adaption of the computer typewriter-style keyboard for musical purposes.
Interval is published by the Interval Foundation, P.O. Box 8027, San Diego, CA 92102, USA.

Each issue of **Musical Six-Six Newsletter** is devoted to the 6-6 keyboard and related matters. It is published semiannually by Thomas S. Reed, at P.O. Box 241, Kirksville, MO 63501, USA.

Electronic Musician's November 1986 issue, Vol. 2 #11, focused on alternative tunings, with several keyboard-related articles. Most of them discuss reassigning the pitches on electronic keyboards of the standard layout.
EM's address is 2608 9th St., Berkeley, CA 94710.

Keyboard Magazine's January 1987 issue is a special issue on alternative keyboards. Conversations with the people putting it together indicate that it contains some good, innovative stuff.
Keyboard is published at 2005 Stevens Creek Blvd., Cupertino, CA 95014.

Articles in **Experimental Musical Instruments**:

"Conduit Marimbas and Glass Marimbas, designed and built by Stephen Smith," in Vol. II #1, describes Stephen Smith's use in his marimbas of Erv Wilson's adaptation of the Bosanquet keyboard.

"The Megalyra Family of Instruments, designed and built by Ivor Darreg," in Vol. II #2, describes the fretboard marking system devised by Darreg to locate the pitches under the strings of his steel guitar style instruments. While these are not keyboard instruments, Darreg's thinking does a lot to illuminate the subject of schemes for laying out sets of pitch relationships on the instrument.

"Polychord I and Microtonal Steel Guitar Fretboards," by Siemen Terpstra, in Vol. II #4, discusses the author's approach to the same subject as the Darreg article above, describing his elaborate and beautiful tonal fretboard overlays.

THE SOHLER KEYBOARD SYSTEM
Designed by Mel Sohler

Article by Mel Sohler

"Wow, you've really got something there!" I've heard it said to me many times. "But I sure don't envy you in getting the world to change over to it!" No, it sure isn't easy to get people to change set ways of training, tradition or convention, especially if a certain way of doing something has been around for a few centuries. What am I referring to? I am speaking of musical keyboards -- pianos, organs, and in recent years electronic keyboards and synthesizers. That is, the keyboard itself, used to actuate those sounds, composed of those familiar white and black keys that we have all seen so many times, and whose key arrangement has been around for generations, whether it be on an old foot pump organ, piano or modern poly-voice synthesizer.

If I watch MTV or weekend music videos and the camera does a close-up of the keyboardist's section, this gnawing feeling gets in my stomach and I immediately think, "Ha, it ought to be The Sohler Keyboard getting that camera close-up!" Or maybe I'll think, "Yeah, that's a spacey-looking new keyboard instrument, but it would be much better if the had the right keyboard to go with it to really make it more functional and futuristic."

So yes, I admit it, I am biased in favor of The Sohler Keyboard!

By now you're asking, "Okay, what is The Sohler Keyboard?"

The Sohler Keyboard is a logical and practical arrangement of the keys so that a keyboard instru-

(continued next page)

Instrument builder and microtonalist Ivor Darreg recently sent us this article which he had long ago clipped and saved, and with it some current observations of his own. The article appeared in Time Magazine in 1964, raising the hope of a brighter future for a war-weary instrument.

Ivor has also written a booklet on the subject, titled Shall We Improve the Piano?

INSTRUMENTS
PIANO ON THE HALF SHELL

The piano is dying. So is the pianist -- of exhaustion. Or so claims Monique de la Bruchollerie, one of Europe's top concert pianists. Modern piano compositions have become so wickedly difficult to play that to get by today the pianist must be something of a contortionist -- gyrating, flailing, crossing hands, crouching spread-eagle fashion to play both ends of the keyboard simultaneously. To rescue both piano and pianist from extinction, Monique has designed a new instrument -- a kind of piano on the half shell.

Noting that watchmakers work at curved desks so that their tools are more accessible, she has designed a crescent-shaped keyboard that places the top and bottom keys within easier reach. In addition, she has converted the loud and soft pedals into bars extending the length of the curved keyboard. With feet freed from the center of the piano, she says, the pianist can then swing to either end of the keyboard without having to do a sitdown version of the twist.

She also proposes to tack on five notes at the bottom and ten notes at the top of the keyboard to expand the sound range of the standard piano (from 27.5 to 4,186 cycles per second) to come closer to the range of the human ear (from approximately 16 to 20,000 cycles). Her most far-reaching innovation is a push-button electronic system whereby the pianist can play from two to twelve notes simultaneously by striking one key. In effect, she says, this device "will give the player 30 fingers." It will also allow the piano to be "programmed" like a computer, multiplying its creative potential for modern composers, whose interest in writing for the piano has been flagging.

With the support of France's famed Pianist-Teacher Marguerite Long, Monique is negotiating with piano manufacturers. Despite engineering problems, she hopes to have a working model by the end of the year. To traditionalists who balk at her spaceage innovations, she explains: "The evolution of these instruments has been steady. The clavichord said all it could. Then came the pianoforte, and eventually it said all it could. The time has come to give the piano a new franchise, a new life. A golden era is opening for the piano, if only the piano is ready for it."

CURVED FUTURE KEYBOARD

Ivor comments:

Twenty years have passed since Time magazine published the above article, and I have been unable to find any information about Mme de la Bruchollerie's super-piano anywhere. Was it built?

I am inclined to doubt it. Piano design is the frozenest of all: what other wooden machinery besides the piano action still survives? Even today's harpsichord jacks have gone to plastics!

Observe the uncanny resemblance of the Clutsam keyboard to the Bruchollerie proposal. [The Clutsam keyboard was a similarly curved arrangement first proposed in 1907] No! Not plagiarism at all! Lack of communication, and suppression of knowledge by selfish reactionary interests.

The Janko keyboard, conceived in 1862 and patented in 1882, is another example of suppression: What a tremendous amount of wasted effort and wrong notes it could have saved pianists all the last century!

Let us hope that the new instruments will not be deliberately held back to now-obsolete piano design criteria.

A YAMAHA DX7 SYNTHESIZER FITTED WITH THE SOHLER KEYBOARD BY MEL SOHLER.

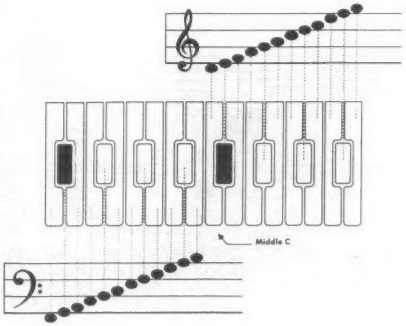
ment can be learned and played in a simple, straightforward manner. The ability to learn and play chords, scales, etc. is accelerated because fewer fingering patterns need be learned due to the keyboard's inherent symmetrical design. This repeating-pattern-effect helps to reinforce music theory. Coupled with **Sohler Notation**, this eliminates confusion in sight reading because notes on the staff are easily identified and correlated to the correct keys on the keyboard.

A few years ago my desire to play the piano manifested itself, and I took a dozen lessons. It became clear to me with those few lessons that to play and sight read with the conventional keyboard and notation was no easy task. It was difficult enough to make the fingers act and press keys in conjunction with the eyes reading notes. But then when I had to add more mental work in un-scrambling and making sense of sharp and flat symbols, key signatures, different fingering patterns for different keys, etc., it seemed a monumental task if there was going to be any hope of proficiency.

That's when I decided to search for a possible solution, or an alternate method which might reduce the confusion and busywork the conventional keyboard and notation entail. Setting and working with certain parameters, I designed and created a new key arrangement. A companion notation system to **The Sohler Keyboard** closely followed, thus resulting in a totally new and simplified approach to keyboarding.

THE KEYBOARD: Arranged symmetrically, the twelve keys per octave are divided into four three-key groups. Each three-key group has two white keys and one raised key centered between them. For reference, the C# raised key in each octave is colored or marked. The raised keys are purposely short in length to allow the full playing width of the white keys to be accessed behind, as well as in front of the raised keys for greater versatility.

THE NOTATION: A basic four-line staff is used and is identical for both the treble and bass clef. To see how it works, think of an octave group of the **Sohler Keyboard** from C to C. Between two Cs are four raised keys (C#, E, G, A#). These four raised keys translate directly into a basic four-line staff. A note on a line is always a raised key. The first raised key corresponds to the first line, the second raised key the second line, and so forth. The white keynotes on the keyboard lying between the raised keys are notated in the spaces between lines, either just above, or below the appropriate line. Thus, there is a place on the staff for every note, eliminating the need for sharp and flat symbols in front of the notes. This allows the Sohler Keyboardist to know exactly where the note is played without necessarily having to know the name of the note. It is a direct keyboard tablature. In addition, the first line of each four-line staff is drawn in heavier bold. This corresponds to the C# raised reference key of the keyboard and further helps to tie the two (keyboard and notation) together. A double four-line staff is used for extended note range.



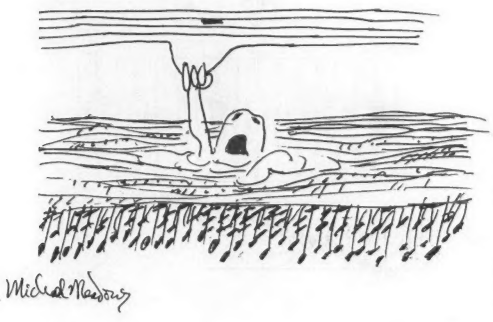
Since the bass clef is identical to the treble clef, the note identification on lines and spaces remains the same, unlike conventional notation. This really saves studying time and busywork!

THE STATUS OF THE SOHLER KEYBOARD SYSTEM: To date I have converted about a dozen keyboard instruments -- several pianos, electronic keyboards, a clavinet, and most recently a DX7 synthesizer. In all cases only the keyboard itself was altered. I continue to do custom conversions of keyboard instruments for individuals.

As an alternative controller for electronic instruments, or as an additional peripheral in conjunction with computers, The Sohler Keyboard System is ideal. With the correct music software for the notation it can make a nice music package for home PC users as well. I am working in this direction. However, I need help in actually making it happen. I have found it takes time, work and money to develop an innovation, and it is also costly to obtain patents, which I do have on the keyboard and notation. I urge people in the businesses -- the music manufacturing and recording industries, computer and software companies, etc. -- to take notice and contact me with the possibility of a mutual agreement to produce and market The Sohler Keyboard. One of my goals/endeavors is to get The Sohler Keyboard to other interested individuals in the world. Help of any kind to accomplish this will be greatly appreciated. Letters from individuals, other musicians, and music educators giving feedback, pro and con, are welcome. Please send correspondence to Mel Sohler, Sohler Keyboards, Pinos Altos, NM 88053, USA.

Hopefully we will see more of the Sohler Keyboard System with its alternate approach to keyboarding in the nearer future. Then, we potential music keyboard artists may manifest ourselves to a greater degree.

Thanks to EMI (a great publication), and you readers for allowing me to share with you, and vice versa.



Michael Masters

BOOKS

PERCUSSIVE NOTES RESEARCH EDITION, VOL. 24 #3/6: DEAGAN CATALOGS

The subject of this issue's "Books" column is not a book in the usual sense; it is an issue -- a double issue, actually -- of an ongoing periodical. We're looking at it here for a couple of reasons. First, it's presented like and has the coherence of a book, in that is devoted to a single subject. Second, the material is very interesting for people concerned with creative instrument design, and it merits discussion in its own right, separate from its parent publication.

Percussive Notes is the publication of the Percussive Arts Society, the prominent international organization for percussionists. Intermittently they publish a "Research Edition," specifically devoted to articles of historical or scholarly interest. For this most recent issue, the editors managed to obtain permission to reprint under one cover a set of five early catalogs put out by the Deagan Company, manufacturer of percussion instruments. Deagan is now known primarily for fine marimbas and xylophones. Nearly forgotten is the fact that Deagan once produced an wide array of truly remarkable, innovative and imaginative instruments. The catalogs reprinted here include descriptions and drawings of about seventy of them.

Unfortunately, nowhere are the catalogs dated. Other sources tell us that J.C. Deagan began his work with marimbas around 1910, and at least one of the instruments described in the catalogs was introduced around 1920. Beyond that I can only say that the writing style, the graphic style, and the approach to commercial promotion all seem now like voices from a world long past.

The drawings of the instruments are very finely rendered, though coarsely screened for reproduction. The original catalogs from which the current reprints were made appear to have been somewhat the worse for wear in places -- a fact that, far from than detracting, turns out to have a rather endearing effect. In the final result most of the depictions of the instruments are clear and readable. A few have been sufficiently muddled between the original production, the well-worn catalog and the new reprint, as to be difficult to make out in detail.

The purpose of the catalogs was first and foremost commercial, and that fact is reflected in the descriptions. Instruments are "swell" and "sure to make a hit;" they are covered by "many letters patent in all leading civilized countries of the world" (p. 37). J.C. Deagan himself is "universally recognized as the world's greatest acoustician" (p. 144). But the text, with the aid of the fine illustrations, is generally clear enough to give an understanding of what each instrument is about.

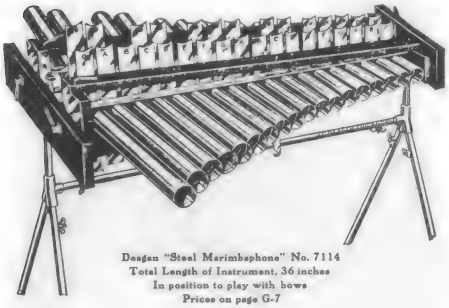
OK, so what are some of the instruments?

The first of the catalogs describes the Deagan Company's musical bells. These include standard handbells and various mountings for bell sets, some including attached tuned air chamber resona-

tors, and some incorporating some clever innovations to extend the range and facility of a single handbell player. In addition there are tuned cowbell sets and tuned sheep bell sets, and -- here's the one that I'd love to hear -- tuned sleighbell sets, mounted on a framework for ease of playing.

The second of the catalogs lists "Orchestral Bells," meaning the small metallophone bar instruments also sometimes called glockenspiels. The third describes a number of xylophones. These two catalogs contain information on some lovely instruments, along with some interesting discussions of woods used at a time when tropical hardwoods were more plentiful. From a current perspective, though, the instruments are not unusual. They were more novel at the time of their manufacture.

The fourth catalog covers marimbas and marimbaphones. What's the difference between a marimba and a marimbaphone? The marimbas described are essentially the same as the instruments associated with that name today, except that included among them are instruments with metal bars. By contrast, "marimbaphone," as the Deagan company used the term, referred to instruments which could be played either with mallets like a standard marimba, or with a bow. This included instruments of both metal and wood. The Deagan marimbaphones had a mechanism which allowed the bars along with their resonators to be rotated ninety degrees -- that is, flipped up so that the bars stood vertical and the resonators stood out horizontally, making the ends of the bars more accessible for bowing. In addition, the bar ends were scalloped to keep the bow from sliding off to the side.

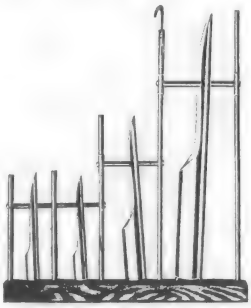


Deagan "Steel Marimbaphone" No. 7114
Total Length of Instrument, 36 inches
In position to play with bows
Prices on page G-7

The fifth and last catalog is titled "Deagan Musical Novelties." Almost everything appearing is this one is of extraordinary interest. To mention a few:

The Deagan Company made something they called "Organ Chimes." It consisted of a tuned set of devices identical in design to anklungs. (Anklungs are a peculiar form of bamboo frame-rattle from Indonesia. They are definitely-pitched, and in their homeland they do appear in tuned sets.) The differences between the organ chimes and traditional anklungs were, first, that the Deagan rattles, while identical in shape, were made of metal, and, second, that they were mounted on a rack for ease of playing. The name "organ chimes" may have been intended as a reference to the fact that the metal rattles, like their bamboo counterparts, contained three or four sounding elements

"Deagan Organ Chimes"



A Deagan Organ Chime
Removed from Rack and Ready for Packing

within each frame, tuned in fifths and octaves -- reminiscent of the registration of a large pipe organ.

Deagan also made something called an Aluminum Harp. The harp was a set of tuned metal tubes mounted in a rack, which were to be played by stroking with rosined gloves. The tone is described as "similar to that of musical glasses but of greater depth and volume."

The Deagan Musical Rattles were, as you might guess by now, tuned sets of rattles. They took the form of ratchets of the sort that are played by holding the handle and swirling the body around. Several varieties were available. Some were designed to be played individually by hand in the usual way, and some were mounted on a rack and played by turning the crank, "same as a coffee mill."

Finally, there were Deagan Musical Coins. These were tuned steel disks of diameters ranging from three to six inches. They were to be played by spinning them -- no kidding -- on a marble table top. A full chromatic two octave set was available, at a cost of $2 apiece.

These catalogs speak of a time when people spent a lot less time with passive entertainments, and when active music making had a natural place in more people's lives. In addition to reminding us of some of the spirit of a past time, they provide us here in the present with some refreshing thoughts on possible musical sound sources. The Percussive Arts Society has done us a real service in reprinting them.

INSTRUMENTS

A SET OF ALUMINUM JUST-INTONATION TUNING FORKS
by Warren Burt

Warren Burt is an American composer living in Australia. In this article he describes a set of hand-held tuning forks he has created. What is especially interesting about these instruments is not so much their design, or how they sound individually (though the tone is wonderfully clear, pure and long-sustaining), but rather how the players handle them in performance. On a physical level, the individually-held forks can be manipulated freely to modify their sound. On a social level, some very appealing possibilities appear in the musical interaction of a group of people, with or without musical training, holding such simple yet fully musical sound sources. In the article below, Warren describes the design and construction of the forks, and then goes on to describe some of the ways he has brought out their musical and social potential.

About 1970, Edward Keyes, a friend who dabbled in acoustics, showed me a set of eight aluminum tuning forks he had made and tuned to the C major scale. These were band-sawed out of 20 x 40 mm aluminum. They filled the octave ending on the C above the treble staff, and had a lovely pure tone that rang on for about thirty seconds. At that time, he gave me a reject fork from his project, one tuned to approximately the D above his highest C, suggesting that I might find a use for it.

Over the years, that fork was used in a variety of contexts. It was especially useful between 1976 and 1979, when I was a member of the live electronic performance group Plastic Platypus, which specialized in performances with cassette recorders, home-built electronics and percussive trinkets of all kinds. The high ringing D of Ed's fork can be clearly heard in the recording of Ron Nagorcka's "Atom Bomb" (available on the cassette NMATAPE2, from NMA publications, PO Box 185, Brunswick, Vic. 3056 Australia, for $6.50 Australian plus postage), and forms the central structural element in my 1977 piece "Tasmanian 'D'" for seven cassette recorders, hand-held percussion and hand-operated 7 channel sound switching system. More recently, the fork was used as a solo sound source in my 1985 accompaniment for choreographer Jane Refshauge's realization of Deborah Hay's "Leaving the House," where its single sustained highly directional sine-wave provided an ideal counterpoint for Jane's slow, elegant, and suspended movements.

These experiences convinced me of the desirability of having a set of these forks, and my interest in exploring various tuning systems provided further impetus in this direction. I did not have the opportunity to realize the project, however, until September, 1985, when I was selected to be one of the Australian Commonwealth Scientific Industrial Research Organization's (CSIRO) artists-in-residence, as part of the Australia Council's "Artists and New Technology" scheme. I chose to work at the CSIRO's National Measurement Laboratory (NML) at Monash University in Melbourne, where precise frequency measuring equipment and a small machine shop were available. The forks were made here between September and December 1985.

A just intonation scale of 19 tones/octave was eventually settled on after a number of preliminary experiments. During these experiments, Schlesinger's ancient Greek modes (cf. The Greek Aulos, by Kathleen Schlesinger) and Yasser's 19 tone equal tempered scale (cf. A Theory of Evolving Tonality by Joseph Yasser) were considered. They were eventually passed over in favor of the much simpler just scale used here, based on the theories of Ptolemy and Partch (cf. Harmonics, Book II, by Claudius Ptolemaius, and Genesis of a Music, by Harry Partch). The scale that evolved is symmetrical, based on G=392 hz, and has as subsets a number of the ancient Greek genera. Of particular acoustic interest are the beating pairs of tones 10/9 & 9/8, 7/5 & 10/7, and 16/9 & 9/5, which produce quite lovely beats when played together.* For those interested in just tuning, here is the scale the forks are tuned to:

RATIOS:>	1/1	28/27	16/15	10/9	9/8	6/5	5/4	9/7	4/3	7/5
CLOSEST PITCH IN E.T.>	"G"		"G#"		"A"	"A#"	"B"		"C"	"C#"

RATIOS:>	10/7	3/2	14/9	8/5	5/4	16/9	9/5	15/8	27/14	2/1
CLOSEST PITCH IN E.T.>	"C#"	"D"		"D#"	"E"	"F"		"F#"		"G"

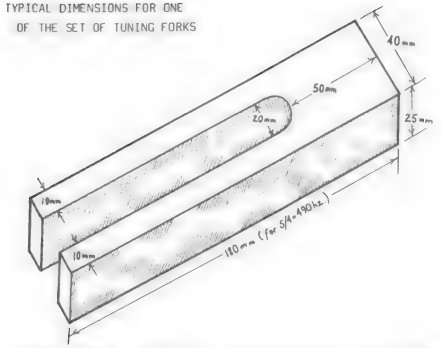
The forks themselves are made of standard aluminum bar, 25 x 40 mm for the top two octaves and 40 x 40 mm for the bottom two octaves. A number of experiments were carried out to determine the optimum design for them, and to see how the sound they made could be controlled. The end design had two tines ten mm wide of equal length on top of a fifty mm base. The length of tines varied as pitch varied. A computer program written by Robert Rigby of the NML calculated the lengths of bar necessary for each fork, and the amount of aluminum necessary to be milled off to fine-tune each fork. The metal work on the forks was carried out by myself, with very helpful and necessary assistance from NML's Stan Boothey, Ken Peel, and Ron Cook.

There are a total of 89 forks. Four octaves

*These ratios and those given below, in keeping with nomenclature encouraged by Harry Partch and now gaining wide currency, are a means of precisely indicating relative pitch relationships. The numerator and denominator correspond to the frequencies of two pitches, in this case, the frequency of a higher scale degree over that of the basic pitch on which the scale is built.

The word "beating" here refers to the tremolo-like rise and fall in volume that results as two simultaneous vibrations of close but not identical frequencies move in and out of phase, alternately reinforcing and cancelling one another.

"E.T." on the chart below refers to 12-tone equal temperament, the standard tuning system in most current Western music.



from G=98hz (bottom of the bass clef) to G=1678hz (an octave above the top of the treble clef) are covered. There are also two lower "experimental" forks of G=49 hz. and D=72.5hz., a few duplicated tones, and six "mutant" forks of tones dissonant with the scale that were made in the course of the work and were interesting enough to keep: 25/24=204.1hz, 35/18=381.1hz, 25/21=933.2hz, 297/200=1164.3hz, ca. 297/200=1164.7hz (these last two producing a very attractive high, slow beating), and 256/243=206.4hz (a nice low beating partner to the 25/24).

The lower two octaves need resonators and soft beaters for their fundamentals to be heard properly, while the higher forks' fundamentals can be easily heard with a variety of beaters. The lowest two forks are too low for 40 mm aluminum to efficiently project their tones, even with resonators. However, they make lovely deep bass tones which can be clearly heard when held close to the ears. Though amplification could make these two forks heard easily, I actually prefer to think of them as quite personal instruments, performable for only one person at a time.

The forks were made as follows: The aluminum bar was first sawed slightly longer than required on a circular metal saw. Then a 20 mm diameter hole was drilled in the center of the bar, 50 mm from the base end. A band saw was used to saw from the tine end to the hole, thus creating the groove. After that the inside of the tines were made smooth with a milling machine, although this was primarily for cosmetic purposes. For tuning, if the fork was flat, very small amounts of metal could be milled off the ends of the tines. If it was too sharp, the end of the groove could be slightly milled away to bring the fork into tune, though this was not as accurate a tuning method as working on the ends of the tines.

There are three principal ways of playing the forks:

1) Hand-held, with one player using only a few forks, and the timbre of the forks modified in various ways, as used in my "Almond Bread Harmonies" series of pieces.

2) Standing on their ends, and lightly struck with percussion beaters. In this use, the sound is very soft, and some amplification has always been used so far when they are played in this mode, as in "Ptolemaic Phase Dances" for forks and moving microphones and "The Exquisite" for solo fork performer wearing binaural microphones.

3) Mounted in a frame specially made for them which holds specially tuned resonators, and played in the manner of a normal keyboard percussion instrument. A frame capable of holding twenty forks and resonators has been made which allows both forks and resonators to be easily changed, allowing various scales and collections of pitches to be used at various times.

Method 3) provides great traditional musical flexibility, and for practical reasons, I have used the second method for a number of solo performances. But my favored way of performing with the forks is the first: hand-held and performed by a number of players. This is because in this mode the forks become not so much a musical instrument as a set of flexible sound resources for community music making. I find this concept much more socially appealing than the idea of simply making another instrument for musicians, professional and otherwise, to play. In this mode, a great number of people can explore playing and making sound together, and because the level of skill required to play the forks is so easily taught, lack of musical training or experience is no barrier. Thus, the experience of social music making is available to at least a few people that it might not otherwise have been.

In the hand-held mode, a number of timbral modifications of the forks are possible. They can be struck and then moved slowly or rapidly through the air, creating various doppler and phase-shifting effects. The lower treble ones can be moved close to the mouth and the changing shape of the mouth cavity used as a resonator. The highest forks can be held close to the mouth and whistling tones around the frequency of the forks can produce soft difference tones. Cardboard tube resonators can be moved close to the forks, or the forks moved over the ends of the resonators, to produce changes in amplitude. All of these techniques are used improvisationally in my recent pieces "Almond Bread Harmonies I & II" for five players of treble tuning forks. (A longer description of a number of pieces for the forks can be read in an upcoming issue of **Interval**). Another possible modification is attaching a stiff index card to one of the tines with brown packaging tape. This produces a delightful buzzing sound reminiscent of the mbira. Needless to say, all these performance techniques are highly theatrical, producing a visually attractive performance.

The essence of the forks is ultimately timbral. The long decay (ca. thirty seconds) of the pure sine waves the forks produce, coupled with the just tuning (and here we could ask just how much tuning effects, or is even to be considered a subset of, timbre) produces an overall "sound" that is quite distinctive. The forks, indeed, are not a universal instrument, capable of adapting to a great number of musical styles. They make only their own music, but the scope of that music is just beginning to be discovered.

THE FIPPLE PIPE

Designed and Built by Denny Genovese
Article written by Denny Genovese

The Fipple Pipe came about by accident. In 1978, while building instruments for the Just Intoned Orchestra at the Free Flow Center in Honolulu, it was recognized that we needed wind instruments to give life to the percussion, string and electronic instruments we had built so far.

The objective was a metal or wooden flute that would play the scale of the harmonic series. Since I could not get sound from a cross flute, I installed a fipple mouthpiece (the sound producing system used with recorders and whistles) on a long metal tube, with the idea of cutting the tube to length so as to get the lowest note, and then to drill finger holes for the higher tones. A good deal of experimentation was expected.

Imagine my surprise and delight, however, when I blew on the undrilled flute and heard a shift from one tone to another! I discovered that it was possible to play up to twelve different tones, without any finger holes, simply by varying breath pressure. Hoorah! It was the harmonic series, built in automatically by the laws of nature!

To this combination of the fipple mouthpiece and the long, undrilled tube I gave the name **Fipple Pipe**. I began to make Fipple Pipes for friends and gave them as presents, in the hope that the beauty of the harmonic series would be experienced first hand by as many people as possible. Soon I was selling them, too.

Before long, I had learned quite a bit about the nature of vibrating air columns, but now, eight years later, I'm still learning as much as I was then. Fipple pipes function differently from other fipple flutes such as recorders (which can overblow only a few harmonics effectively) primarily because the tubes are much longer and relatively narrower. This principle holds true between differently sized Fipple Pipes as well. With a very long Low C Fipple Pipe you can get 17 harmonics, while the pipe pitched an octave above will only give you eight. This may be simply because there is more room in the longer pipe for the sound wave to break up into shorter sections. Additionally, the absence of finger holes makes for distortion-free nodes, allowing the wave to divide naturally into equal segments. In fact, attempts to put finger holes in Fipple Pipes confound the natural process.

Since that first pipe was made, a family of Fipple Pipes has evolved, with instruments in graduated sizes and keys. The practical gamut is between the Low A pipe, which best plays the range between the eighth and twenty-first harmonics, and the very high F which plays the first through fifth harmonics. The longer pipes have more range (more pitches available) but require more concentration to play than the shorter ones, which are louder but have less range. The most musical for solo work are the pipes between the Low C and the F, with the D and E being most popular because of their range and ease of playing between the fourth and twelfth harmonics. For bugle calls and for beginning ensemble practice the pipes between A and high D are best, while in general the middle range of pipes between C and High C are the most useful for all around ensemble and solo playing.

The mouthpieces are standard recorder-style fipple mouthpieces, and the tubing is usually aluminum. Other materials such as brass, copper and iron can and have been used for special orders; likewise pipes in non-standard keys are readily produced. The instruments are relatively inexpensive and look good all polished up, especially under dramatic lighting. The tone quality is rich and pure, sounding much like the metal orchestral flutes, but with the natural scale.

While the Fipple Pipes require practice to be mastered (I don't really know anyone who has become a virtuoso yet), it is easy for anyone to improvises with them, since all of the tones available on a single pipe sound good with each other, and no special skill is required to get sound out of it. This makes it possible for an ensemble of completely inexperienced players to improvise together and sound good, so long as all the Fipple Pipes are in the same key.

Since the lower part of the harmonic series does not include all of the tones contained in the diatonic or chromatic scales, it is necessary to alternate between two or more pipes, tuned in complementary keys, when playing most of our familiar tunes. This can be done by one player, or by an ensemble.

When ensembles play with two or more Fipple Pipes in complementary keys, the melody will be shared among them, each player sounding the notes playable with his/her pipe at the appropriate time. When a melody note is being played by one player harmony notes can be sounded by others. Parts can be written in such a way that each player sounds a sequence of tones constituting melody one moment and harmony the next, as the melody is continued by another player. This system of sharing the melody and harmony among multiple players (known as hocketting) is very good for group consciousness and attunement, since pride must come through the success of the group rather than the skill of one particular soloist.

On the other hand, it is possible for a single player to sound very good and perform wonderful music with one or more pipes, either alone or with accompaniment. It is also possible for one person to play Fipple Pipes and other instruments simultaneously, since no hands are required when the pipes are held in playing position by racks or microphone stands.

Fipple Pipe scores and parts can be written in standard notation, but I have found it awkward, because standard notation is intended for diatonic and chromatic instruments, while the harmonic series has different characteristics. However, a little thought and some experimentation have

brought about a notation system especially suited to the harmonic series scale. This notation system uses the same five line staff as standard notation, but with a different system for the placement of notes upon it. (See the sample and explanation below). The scheme is much easier to play from than standard notation, because the sequence of notes on the staff corresponds exactly with the order of tones playable on the instrument. This means that no flats, sharps or other modifiers are required, even though some of the tones depart noticeably from those of the conventional scales.

This brings out the point that while conventional music can be played with Fipple Pipes, with all the power and beauty of just intonation, it is also possible to create completely new, unconventional music, since there are intervals available which are not a part of the conventional system. When Fipple Pipes in various keys are combined, the possibilities for music in completely new scales with intervals **unheard** by **anyone** are literally **infinite**!

FIPPLE PIPE NOTATION

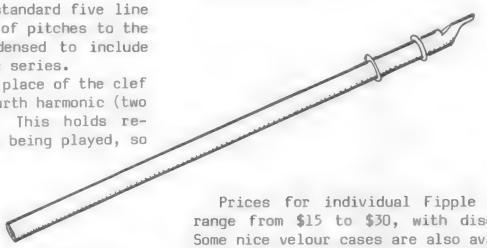
Fipple Pipe notation uses a standard five line music staff. But the assignment of pitches to the lines and spaces has been condensed to include only the pitches of the harmonic series.

In the sample below, the 4 in place of the clef indicates the location of the fourth harmonic (two octaves above the fundamental). This holds regardless of the key of the pipe being played, so that a given line will represent different sounding pitches for different pipes. The lines and spaces above and below correspond sequentially to the pitches of the harmonic series, so that the lines always represent the odd numbered harmonics and the spaces the even. The piece is "The March of the Wooden Soldiers," from Babes in Toyland, played through hocketting between an A and an E pipe. The first four bars, in conventional notation, would read as follows:

FOR MORE INFORMATION...

A book is available, titled **A Short Introduction to the Fipple Pipe.** It tells of playing techniques, maintenance, notation and ensemble methods. It has several musical examples that are well known and easy to play. The price is $2.50 plus postage.

A tape is in the works that will illustrate solo and ensemble techniques. In the meantime, there is one segment on my tape, **Denny Genovese -- Collected Recordings** in which Fipple Pipes are used with the Free Flow Orchestra. That tape is available for $5 plus postage. (The Free Flow Orchestra, mentioned here and at the start of this article, was an ensemble of builders and players of unusual and experimental instruments working at the Free Flow Center in Honolulu in the late seventies.)

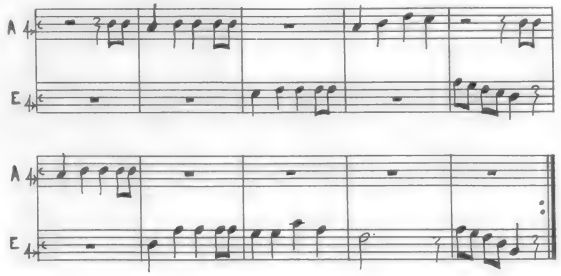


Prices for individual Fipple Pipes currently range from $15 to $30, with discounts on sets. Some nice velour cases are also available.

To order tapes, books or instruments, arrangements of specific music for fipple pipes, or for more information, comments, or whatever, please write:

Denny Genovese/Unique Musical Instruments
P.O. Box 993
Nokomis, FL 33555

"MARCH OF THE WOODEN SOLDIERS"
in Fipple Pipe notation.



ORGANIZATIONS AND PERIODICALS

Experimental Musical Instruments regularly reports on organizations and periodicals of potential interest to its readers. In this issue we look at organizations devoted to some of the world's less honored instruments.

VIERUNDZWANZIGSTELJAHRSSCHRIFT DER INTERNATIONALEN MAULTROMMELVIRTUOSENGENOSSENSCHAFT, AND SAWING NEWS OF THE WORLD

I have before me now newspaper clipping from the Torrance, California **Daily Breeze** of 9/17/84, with an article entitled "Crazy for Kazoos." It describes an irrepressible band of kazoo-players, and near the end of the article there is a reference to an organization called **Kazoophony** based in Rochester, New York. When I first saw that, I said to myself, "A fraternal society for kazoo people! I'd like to know more about this" -- and I began an effort to track the group down. But telephone information for Rochester, New York had no listings under either Kazoophony or the person's name given in the article in connection with it. Kazoophony could not be found in any of the national directories of organizations, and no periodical by that name or on that subject appeared in the existing reference listings of journals, newsletters and such.

It was with deep regret that I abandoned my search.

But there are other organizations and periodicals devoted to some of the seemingly humble folk instruments. Two instruments that have been honored thus are the Jew's Harp and the Musical Saw. So, while Kazoophony may have gotten away for the time being, we can still present here a pair of organizations of equal interest.

Vierundzwanzigsteljahrsschrift der Internationalen Maultrommelvirtuosengenossenschaft, better known as VIM, is the Jew's Harp publication. In style it is a sort of scholarly journal with a sense of humor. VIM 1 appeared in 1982 or '83; Vim 2 in 1985. VIM 3 has not yet appeared. Frederick Crane, music professor at the University of Iowa, is the editor and prime mover. In his "Editor's Notes" in VIM 2, he has this to say about VIM's irregular publication schedule:

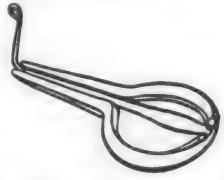
"VIM... is not a periodical, which name would imply that it appears at some regular interval of time, but rather a spasmodical. Such publications appear when, and only when the editor is seized by a spasm. I like the concept very well indeed, as it frees one from all subjugation to the usually dictatorial march of time."

Many articles appearing in **VIM** are historical or literary in orientation; others are of a practical bent. Included in **VIM 2** are (among others) "Notes on Jew's Harp Advertising in the Mid Nineteenth Century, with an appended Glee," by James W. Kimball; "**Punch** and the Jew's Harp," by Frederick Crane (a review of appearances of the instrument in **Punch** cartoons in the nineteenth century); "Some Strategies for Tuning and Improving a Factory Jew's Harp," by Mike Seeger (the well-known all around folk musician turns out to be a leading Jew's harp player as well); and "An Annotated Checklist of Microgroove Records with Jew's Harp Music," by Paris-based Vietnamese musician Tran Quang Hai. Also included are reprints of some early poems, graphics from early advertisements and similar items pertaining to the instrument.

In September of 1984 **VIM** hosted the first **International Jew's Harp Congress** in Iowa City, Iowa. Professor Crane's report on the event makes it sound genuinely entertaining and educational. Along with the concerts, discussion groups, mass performances and such, participants were invited to test and rate all of the brands of Jew's harps commercially available in the U.S.. In a later event they were treated to an hour's worth of Jew's Harp scenes from movies. One result of the congress was an agreement to create a society for Jew's Harpists, to be called The Worldwide Association of Noble Guimbardists. "There will be no officers, no organization, no dues and no regular meetings," Professor Crane reports, "but the important things -- T.W.A.N.G. T-shirts -- will be forthcoming."

For more information on **VIM**, write

VIM
930 Talwrn Ct.
Iowa City, IA 55240.



Sawing News of the World is the only periodical publication in the world devoted to the musical saw. It is published sporadically by a musical saw manufacturing company, Mussehl and Westphal. Most of the articles in the four-page newsletter are on various players of the instrument and their activities. There also are lots of testimonials -- letters from saw players around the world describing their experiences, talking about what a fine thing it is to play a saw, and frequently praising the Mussehl and Westphal saws.

Most sources suggest that widespread musical use of saws began in the mid-nineteenth century, and reached its height around the third decade of this century. Its decline thereafter has been attributed variously to the depression, to the advent of the similar-sounding electronic Theremin, and to an eventually tiresome overuse of the instrument's natural tendency to wide vibrato and portamento. Regardless, it produces a wonderful sound, and plenty of people are still around playing it, writing for it and recording with it.

It is played by clamping the handle between the knees and holding the upper end with the other

hand, forcing it into an S shape. Originally it was struck with a mallet; now it is more often bowed. The pitch is controlled by varying the amount of flex in the blade.

The Mussehl and Westphal saws differ from carpenter's saws in that the blade of the musical saw is thinner and made of a softer steel. The resulting tone is more consistent, and the possible range greater, reaching two octaves and more.

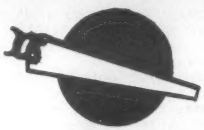
Clarence Mussehl started the company sometime around 1921. He had become enamored with the possibilities of the musical saw after seeing one played by a novelty musician in a vaudeville show. After developing some facility on a carpenter's saw himself -- there were no special musical saws at the time -- Mussehl managed to spend a week in the shop of the Atkins Saw Company in Indianapolis experimenting with different dimensions and alloys. Shortly thereafter he founded his company, manufacturing the saws in accordance with the conclusions of his research. Mussehl advertised liberally in successful magazines of the day, including **Popular Mechanics, The Saturday Evening Post** and **Colliers.** By the middle of the decade the instrument had become tremendously popular, and Mussehl and Westphal was selling between 25,000 and 30,000 saws a year. Business fell off during the depression, suffered from a shortage of steel during the Second World War, rose again in the fifties and trailed off to a trickle after that.

Shortly before his death in 1978 Mussehl sold the business to Dan Wallace, who began advertising more aggressively again and brought sales back up above a thousand a year. Tragically, Dan Wallace died in an airplane crash in 1982. Now running the company and editing the newsletter is his wife (now remarried) Mary Kay Dawson and their son Jim Wallace.

For more information on **Sawing News of the World** and the Mussehl and Westphal saws, write

Mussehl and Westphal,
Delavan, WI 53115.

Also for saw enthusiasts, there is an annual musical saw festival in Portland, Oregon. The 1987 festival will take place over the long weekend of August 21-23, running from 10-5 each day. Approximately three dozen highly-reputed saw players from around the U.S. will be performing. The festival was originally sponsored by KUSP radio in Santa Cruz, but in recent years it has been run by the World Forestry Center in Portland. For more information contact them at 4033 SW Canyon Rd., Portland, OR 97221; (503) 228 1367.



Meanwhile, if anyone has information on Kazoophony, please let EMI know.

NEW INSTRUMENTS IN FRANCE

NOTES GLEANED FROM RECENT WRITINGS
BY PIERRE JEAN CROSET

Pierre Jean Croset is a French designer and builder of new musical instruments. In the spring of 1985 he travelled to the U.S. on a grant from the French government to investigate activity in the field of new instruments here, and to give some talks and concerts. An article on one of his instruments, the beautiful translucent plexiglas Lyra, appeared in **Experimental Musical Instruments** Vol. I #1. He has since written EMI with some of his observations on new instrument explorations in the U.S. and France.

Croset found that in both France and the U.S. much of the activity in instrument building fell into certain broad categories, such as sound sculpture, sound architecture, new instruments capable of playing conventional music, and instruments pointing the way to new and avant garde musical forms. Beyond this, there are a number of differences in approach between the two cultures. Most prominently, Croset was struck by a very different relationship between past, present and future in the U.S. and Europe. The relationship is "very dynamic in the U.S.A., sometimes too quick, with no obstacles of the past for a new idea, no consciousness of the past." In France historical awareness is far greater and has a correspondingly greater influence on the present, creating "a life built with the connections of the Old Past, and the spectacle of the Present Future." (Croset enlarges on this subjects in his separate remarks printed below.)

Looking at the landscape in France in a little more detail, Croset notes that a new ministry of culture has provided better funding since 1981, providing a new push in French cultural life and leading to greater recognition of new instrument builders and their work. One notable recent trend has been the influence of a number of people working somewhere between the traditionalists and an avant garde which accepts any noisemaker as valid art. Many of these people are creating instruments, some unusual in conception and some relatively conventional, with a new emphasis on advanced techniques for fabrication -- not necessarily high-tech, but highly refined.

Francis Isnard, for example, builds flutes in exquisitely finished ceramics. Yvan Levasseur builds specially-designed orchestral instruments -- violins, flutes, oboes, clarinets, various percussion instruments -- again entirely in ceramics, using a special wood firing process. Robert Hebrad specializes in technologies from Indonesia and Africa, building elaborate musical sculptures of bamboo. His Dragon, for instance, is over six meters long, incorporating a lot of Balinese Anklungs into a structure on wheels. The work of Francois and Bernard Baschet is already well known. Their instruments and sculptures are exquisitely fabricated of glass and metal using painstakingly researched and completely original approaches to resonator design and transmission of

vibrations. Arthea (an organization, not an individual), has devoted itself to the design and building of instruments that can be purchased at modest cost, and played by people without musical training, without sacrificing quality. Jacques Dudon has created an optical synthesizer to translate light into sound. Christian Daninos builds beautiful Zarbs and Tars (both instruments from Iran) of fiberglass. And Croset himself works with plexiglas, building water drums, sansas, the 18-string Lyra described earlier, and several more types.

A list of some of the leading new instrument designers in France follows.

Yvan Levasseur, Laborne, 18250 Henrichemont, France.
Ceramic orchestral instruments

Atelier Musical de Provence, 04870 St Michel l'observatoire, France.
An organization of several builders. Members include
Pierre Jean Croset (plexiglas instruments)
Francis Isnard (ceramic flutes)
Christian Daninos (fiberglass Zarbs and Tars)

Arthea, Gestation Sonore, Le Prado, route Napoleon, 06130 Grasse, France.
An organization devoted to creating inexpensive, well made, easily playable instruments.

Jacques Dudon, Atelier d'exploration Harmonique, 2 Traverse la treille, 13360 Roquevaire, France.
Optical synthesizer.

Robert Hebrad, 113 Avenue de la resistance, 91330 Yerres, France
Bamboo instruments

Bernard & Francois Baschet, 11 Rue jean Beauvais, 75005 Paris, France
Instruments and sound sculptures using glass friction rods and metal resonators, among many other things.

PIERRE-JEAN CROSET TALKS ABOUT THE PAST, PRESENT AND FUTURE OF MUSICAL EXPLORATION

I believe that we have as much to learn from the present as from the past.

The present offers us a knowledge developed in western countries based on sciences and the technologies derived from them, for the most part. We must therefore learn to dissociate scientific learning and technological development. Sometimes the latter hides the former; and in the eyes of some artists, technology is mistaken for science. Thus we observe that certain exaltations and celebrations of the relationship between "science and art" are limited to "technological means and artistic techniques." True art is forgotten, and science remains a nameless abstraction. The resulting confusion can be so great that art itself fades into the background. The objects of this confusion remain stranded on the beach of the universe of culture, and between two "waves" are mistaken for the sea of art itself. With the help of the publicity given by the media this confusion tends to become the generally accepted point of view. We should try therefore to appropriate existing knowledge in western countries, while bearing in mind (in order not to proceed with undue haste) the distortions which have brought about the widespread impoverishment of art in the west. For we are in the trough between the cultural era of the sixties and early seventies and the oncoming wave whose shape is becoming distinctly visible on the horizon.

It is one thing to be interested in Europe's past, but we have still more to learn from non-European cultures. We have much to learn from them concerning the conception and construction of musical instruments and concerning the making of music itself. This for us includes the idea of composition, of theories about various things, of writing, etc. -- interesting enough concepts, no doubt, but today often hardly related to our future needs.

Thus we may discover forgotten ways of making instruments (see for example "The Making of Bronze Musical Instruments in Indonesia" by P.J. Croset in **Percussive Notes** 1986) either rediscovered by chance in the west or completely unknown. As another example, using the forge several days running can give better results in 1986 than using unrefined "titan" metal whatever its merits. Using synthetic resin may be more practical than using wood. We must learn to define our aims, and these aims must be strictly musical in character. I say "musical" in contrast to "wanting an instrument and afterwards seeing how it may be used" and in contrast to "making sounds with no definite purpose in mind."

Research into the making of instruments must take into account both the past and the present in order to create new instruments with the purpose of evolving, thereby, the types of music which we are all awaiting, but which are so slow in coming. The problem lies in both the playing of instruments and the area of musical theory: the structure of an Indian raga may be more helpful to us in 1987 than the ideas of Pythagoras (which in fact come from a more recent past). If there is an attraction and an advantage to turning to other forms of culture, it must at all cost be with the humble desire to search for what they have to teach us, **using their language and not our own.**

Besides, ideas and the technical explanations of these ideas should be expressed in language understandable to most people (in contrast to those who write articles intelligible only to those fifteen people using the same language without further popularization). If the results of research cannot be communicated intelligibly to all musicians and other artists who are both competent and genuinely open minded, this research becomes useless.

In conclusion, not only are we in a period in which we must be more open minded, but we must also communicate more easily and more intelligibly with those who aspire to make new discoveries.

NOTES OF A PRIVATE MUSICIAN

The following piece is taken by permission from **The Swallowtail Jig**, monthly newsletter of the Columbine Hammer Dulcimer Society, published by Michael Gowan, 1634 S. Pearl St., Denver CO, 80210. Each issue of **The Swallowtail Jig** contains an installment of the "Great Instruments" series, featuring little-known musical instruments credited to the equally little-known man of letters, Enoch Helm.

GREAT INSTRUMENTS #9
THE MEDICA MUSICA

More a body of knowledge, painstakingly acquired over several thousand years, than a specific instrument, the Medica Musica refers to the power of music to heal, prevent disease or injury and in extreme cases either cause or reverse the processes of aging or death.

A couple of examples will serve to illustrate the thesis:

King Tut's Handbells

These pyramid-shaped objects are of great age and size. For many years they were thought to be the tombs of the Egyptian pharaohs. Many archaeologists still mistakenly adhere to this theory.

Characteristically, the bells were constructed of granite and limestone and finely tuned by complex arrangements of sliding blocks. Because of their great size and weight they could not be played by ordinary men. Instead a unique species of musician from a distant gallery, known as sphinxes were employed by the pharaohs to play the healing music on the bells.

FIGURE 1: When the sphinxes weren't working they annoyed people by hanging around asking obscure riddles which they claimed were really tuning jokes.

In their original use, the dying pharaohs were placed within the bells, while the sphinx musicians played them by means of large mallets and the wind. Each bell was tuned to a specific pharaohs ailment, so they were seldom re-used after a cure was effected.

This is why so few of the pyramids actually had any remains in them. Originally it was believed that this was the result of the depredations of grave robbers. This is a spurious belief, since no person would stoop so low as to actually rob a grave, at least before Victorian times.

The Panacea Pipes

The pipes were actually a hoax for many years, and only recently have they acquired some medicinal value with the development of modern materials.

In ancient times, the healing powers ascribed to the pipes derived more from the mixture of hemp and alcohol which accompanied the playing than from the tunes themselves.

More recently, two new plastics, Cure-R-E and Hex-Ex, both developed by Austin Capella of Sound Research Limited, have been used in the manufacture of the Pipes of Panacea, with remarkable results.

Persons exposed to tunes played on pipes made of Cure-R-E experience significant and rapid relief from the pains of headache, neuritis, neuralgia, sneezes, wheezes and other miseries, including persistent coughs, nagging backaches, stomach upset, toothache, runny noses, shaking hands, stagefright, remorse, guilt, the blues, the blahs and the giggling hahas.

FIGURE 2A

FIGURE 2B

FIGURE 2A: "BEFORE"
Miserable anemic specimen can barely afford enough clothes to cover himself. Forced to pose for muscle magazines in order to buy food.

FIGURE 2B: "AFTER"
Same specimen now hearty and well fed, also well clothed, well shod and well heeled after luck changes for the better.

Pipes made from Hex-Ex exert their influence in a more subtle but perhaps more powerful way. The resonance pattern of the pipes affects the subatomic particle known as "luck" in a variety of beneficial ways.

Persons who listen to tunes played on pipes manufactured of Hex-Ex experience remarkable success in their business and personal lives. One man stopped having car trouble. A woman from Pagosa Springs won the lottery. A young man standing on a mountain top during a thunderstorm with a car antenna in his upraised arm was repeatedly missed by lightning. A handsome, wealthy and popular bachelor, aged 35, suddenly received a call from his maiden aunt Agatha saying that she and her pet poodle Fifi were not going to spend two weeks with him that summer but were going on a tour of European cathedrals with a group from her church.

Other cases exist, too numerous to mention. Unfortunately, the formulae for Cure-R-E and Hex-Ex are not precisely known, so only one set each of the pipes exists.

from "Notes of a Private Musician"
by Enoch Helm

RECENT ARTICLES APPEARING IN OTHER PERIODICALS

Listed below are selected articles of potential interest to readers of **Experimental Musical Instruments** which have appeared recently in other publications.

THE VIOLIN OCTET, by Jody Atwood in **American String Teacher**, Vol. XXXVI #4, Autumn 1986.

This is a general overview of the Violin Octet, emphasizing its history along with information on scoring for the set. The Octet is a set of scientifically-designed bowed string instruments being developed primarily under the auspices of the Catgut Acoustical Society.

A HALF HOUR BEHIND MEANS THEY'RE SLIGHTLY AHEAD, by Gordon Monahan in **Musicworks** 36, Fall 1986 (1087 Queen St. West, Toronto, Canada, M6J 1H3).

This is a review of the 1986 Newfoundland Sound Symposium, a contemporary arts festival in St. John's, Newfoundland. It featured the work of several sound sculptors and new instruments people, notably David Moss, Richard Lerman, Moniek Darge and Godfried Willem-Raes, showing some of the fascinating and unlikely things they've been up to lately.

Ear Volume II #2, Oct. 1986 (325 Spring St., Rm. 208, New York, NY 10013) has two noteworthy articles:

HOWARD MANDEL INTERVIEWS JOHN ZORN presents some of the thinking of the New York avant-garde composer who has done than more anyone else to make game calls a respectable concert instrument.

FROM BALI TO B.C., by Barbara Benary reports on the greatest-ever gathering of traditional and non-traditional gamelan outside of Indonesia that took place at Expo 86 in Vancouver last summer.

In the following issue (**Ear** Vol. II #3), Benary provides a broader perspective on gamelan music around the world in GAMELAN: WORLD GAMELAN UPDATE and NETWORKING.

Journal of the Catgut Acoustical Society #46, Nov. 1986 (112 Essex Ave., Montclair, NJ 07042) has several articles worth noting. Among them:

STRING DESIGN EQUATIONS, by Ian Firth, Rhona Bain and Amanda Gallaher, presents and explains advanced equations relating the factors affecting musical string performance, with special attention to minimizing the discrepancies between single core strings and overwrapped strings.

MODAL ANALYSIS: A PRIMER ON THEORY AND PRACTICE by Kenneth D. Marshal, provides an introduction to modal analysis, defined as "describing the dynamic properties of an elastic structure in terms of its modes of vibration."

SWIMMING WITH DOLPHINS by Jim Nollman, in **Utne Reader** # 19, Jan/Feb 1987 (PO Box 1974, Marion, OH 43305), excerpted from the book **Dolphin Dreamtime** by Jim Nollman.

This excerpted passage describes the use of a Waterphone (described in EMI Vol. II #3) in interacting with dolphins in the water.

THEORY VS. EMPIRICAL REGARDING TONE-HOLE PLACEMENT by Dennis Lawson, in **Techni-Com** Vol. 10 #5 (1836 Chippewa Trail, Beloit, WI 53511).

This article looks at the discrepancies that arise between the theory and the actual event in instrument design, and emphasizes the importance of practical experience. Also includes several practical tips relating to woodwind design and repair.

SHOULD WOODS BE OILED? by Alfred Laubin, also in **Techni-Com** Vol. 10 #5, reprinted from **Woodwind World**, Nov. 1957.

This piece discusses the pros and cons of oiling woodwind woods and reports on controlled experiments. It shows that oiling the wood is of little value for either performance or preservation in many situations where oiling has long been standard practice.

EXPERIMENTAL MUSICAL INSTRUMENTS

Order Form

Subscriptions are $20/yr for 6 issues ($27 outside the U.S., Mexico and Canada). Back issues are available for $3.50 apiece or $20 for all of Volume I. The cassette tape, FROM THE PAGES OF EMI, Volume I, featuring instruments which appeared in EMI's first year of publication, is $6 for subscribers; $8.50 for non-subscribers (postage included).

Please check the appropriate boxes and fill in the subscriber's name and address below, or give the same information on a separate sheet. Mail this along with a check or money order to Experimental Musical Instruments, P.O. Box 784, Nicasio, CA 94956.

This order is for ☐ a subscription; ☐ back issues numbers_____; ☐ the tape.

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